Chapter 20 InRoads Cross Section Development

OVERVIEW

Prerequisites:

- Ground.dtm file loaded in InRoads from Survey MSTA folder.
- A horizontal and vertical alignment developed in InRoads.
- A template design passed through your alignment.

Global Scale Factor

By default when you enter InRoads the **Global Scale Factors** are preset for plan scales at 25 feet to the inch (i.e. 300 absolute scale) in the **mdot_US.xin** file. You can verify what your scales are set to by selecting from the *InRoads Main Menu* **Tools>Options** and select the **Factors** tab. You can also check **Global Scale Factors** if you add the separate dialog through **Tools>Applications Add-ins…** and select **Global Scale Factors Add-In**. This will give you the option to pick **Tools>Global Scale Factors…** and launch an independent dialog.

The **Scale Factors** adjust sizing of your Text, Cell and Line Style placement within your Cross Section drawing set. MaineDOT has two standard scale sizes for Cross Section drawings those scales are 5 feet to the inch (60 absolute scale) and 10 feet to the inch (120 absolute scale).

Locks Toolbar

Feature Filter Lock

Filter locks will aid in displaying what is necessary for the Cross Section presentation. From the *InRoads Main Menu* select **Tools>Customize…** and launch the **Locks** tool bar from the **Toolbar** tab (if it is not already docked within your InRoads platform). Turn the **Feature Filter Lock** on (button next to the pull down will be depressed when on) and select **CROSS SECTION ANNOTATION** from the pull down (Figure 20-1) when you are ready to display annotation within your Cross Section drawing set.

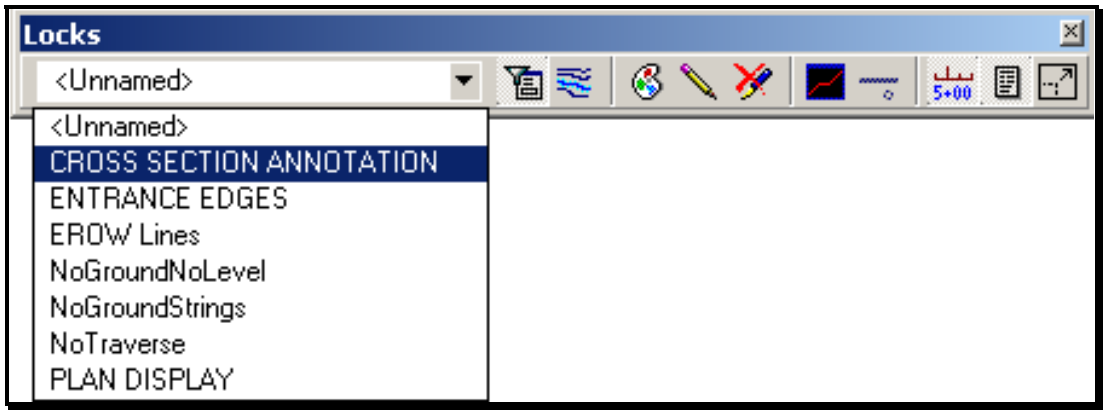


Figure 20-1: Feature Filter lock with various predefined filters.

Station Lock

The Station lock, which is the next to last lock located in the **Locks** toolbar plays an important roll in cutting your cross sections at the even interval specified. The lock should be enabled during Cross Section creation.

Event Stations

Horizontal event stations can be created by the designer for additional sections at critical stations. These sections will be perpendicular to the alignment and will display with either method of developing cross section drawings.

Select from the *InRoads main menu* **Geometry>Horizontal Curve Set>Events…** (Figure 20-2).

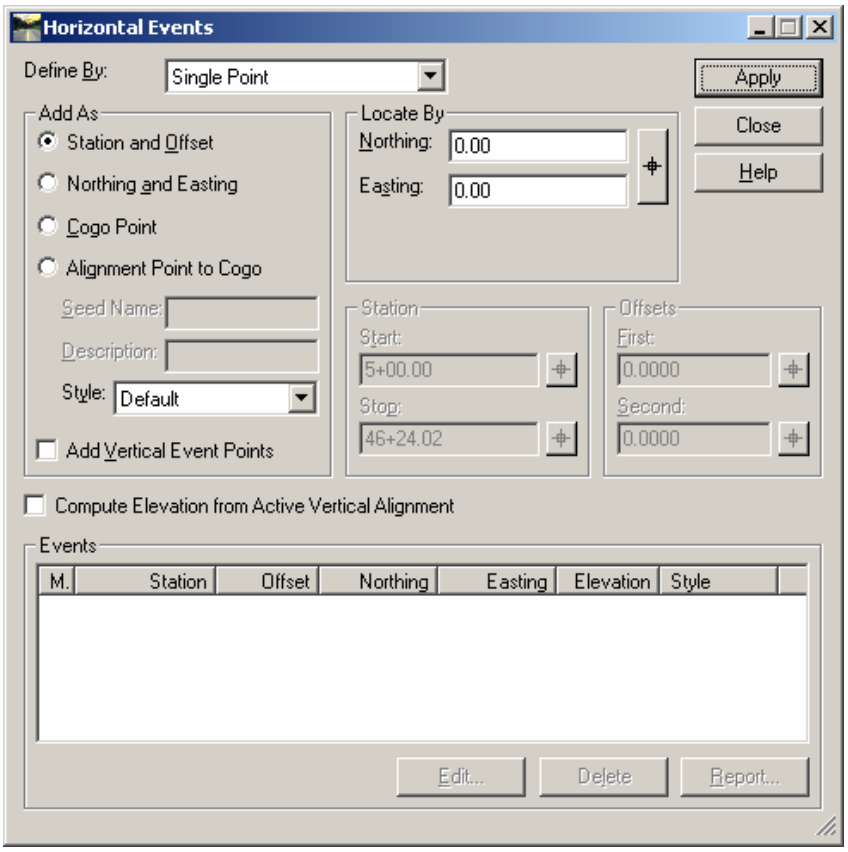


Figure 20-2: Horizontal Events

Set the **Define By:** to **Single Station**, the **Add As** to **Northing and Easting**, toggle on both **Add Vertical Event Points** and **Compute Elevation from Active Vertical Alignment** (Figure 20-3).

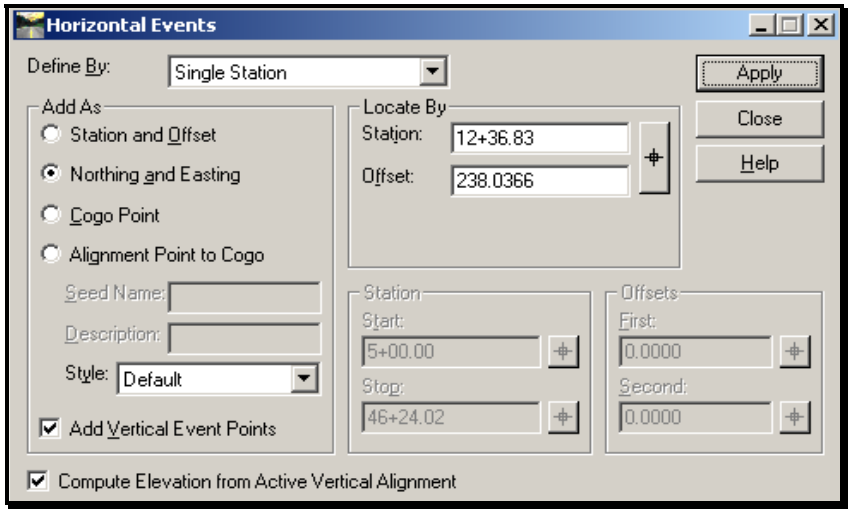


Figure 20-3: Horizontal Events – Settings

Using the target selector in the **Locate By** area of the dialog start selecting areas graphically along the alignment each time selecting **Apply** to populate the bottom portion of the dialog (Figure 20-4).

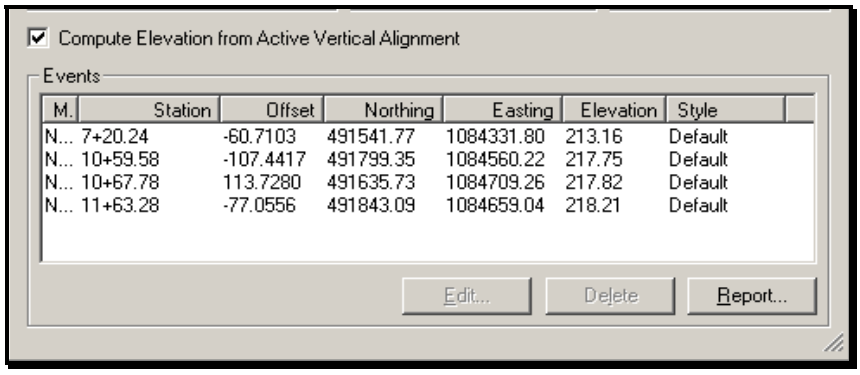


Figure 20-4: Horizontal Events - Events

If there are event stations that are no longer valid to the project than highlight one or more and select the **Delete** button and click **Yes** when prompted. Also existing event stations can edited by highlighting one and selecting **Edit…** to change relative information of that point (Figure 20-5). Remember to click **Apply** as data is changed.

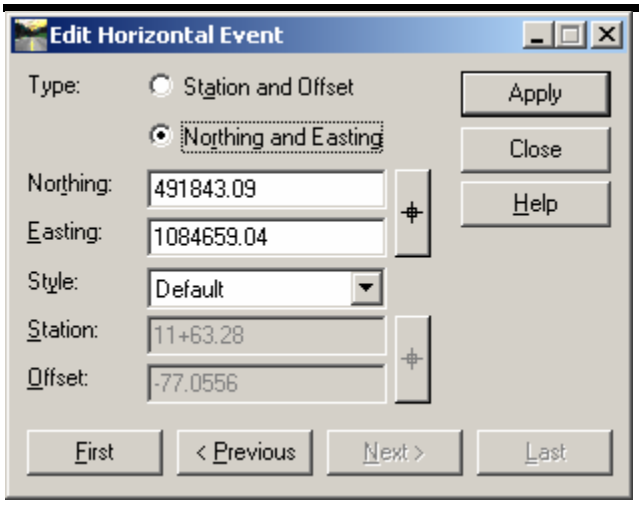


Figure 20-5: Edit Horizontal Event

When done **Close** the dialogs.

CREATING YOUR PRELIMINARY CROSS SECTION DRAWINGS

CREATE CROSS SECTION DRAWINGS

Overview

This is a constant interval set of cross sections for preliminary analysis. These could be stored in your current working **dgn** file or in the **Xsect.dgn** as explained below. Most projects will require special skewed stations which require using the **Custom** portion of the **Create Cross Section** dialog as explained further into this document.

Step One: Open InRoads Suite

To begin, double click your **InRoads Suite** icon. By default the user is set to **InRoads_Network**, if you are working in a local pin setup then you will want to change the user to **InRoads_Local**. Select your project from the project pull down and open your workgroups **??plan.dgn** (i.e. HDPlan.dgn or BDPlan.dgn.). Pick your projects ***.rwk** or load the necessary InRoads files for you project.

Step Two: Create Cross Section Drawing File

Select **File>Makesheetz** from the *MicroStation Main Menu.* Select the **no prefix** option and press **OK,** select **Xsect** and press **OK**, press **OK** again in the next dialog and the program will create your **Xsect.dgn** file in the active directory and opens it for you. Click **Cancel** to exit the program.

✓ ***Refer to page 1-18 for help making drawing files.***

Step Three: Create Cross Sections

Select **Evaluation>Cross Section>Create Cross Section…** from the *InRoads Main Menu* (Figure 20-6).

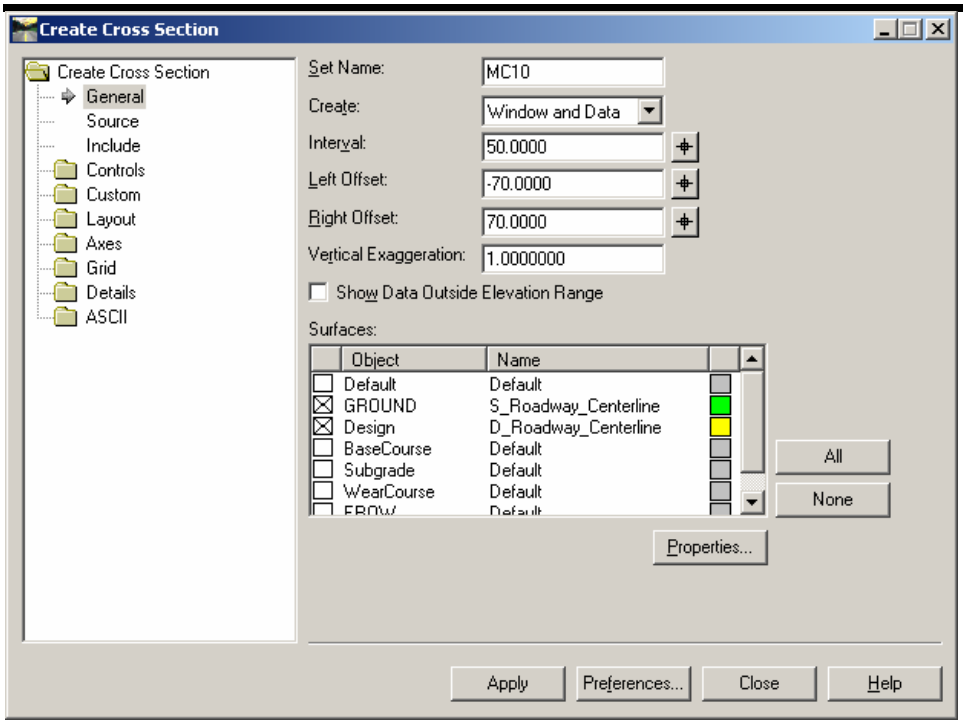


Figure 20-6: Create Cross Section

The default setting for cross section creation is setup for horizontal borders at 5 feet to the inch scale. There are other setups ready for you under the **Preferences…** button of the dialog (Figure 20-7).

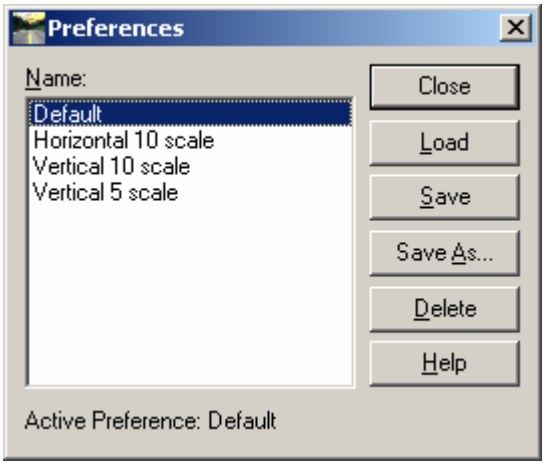


Figure 20-7: Preferences

Select the preference by highlighting it and picking **Load** to the right of the dialog and **Close**.

Step Four: Global Scale Factor

Depending on what you choose to display the cross sections at you will need to set the **Global Scale Factor** before beginning. Select **Tools>Global Scale Factors…** from the *InRoads Main Menu* (Figure 20-8). If you choose to do 5 feet to the inch then set the

scales as shown below or set the **Text:** and **Line Style:** scale to **120** for 10 feet to the inch. The **Cell** scale will stay set to **1** for either scale.

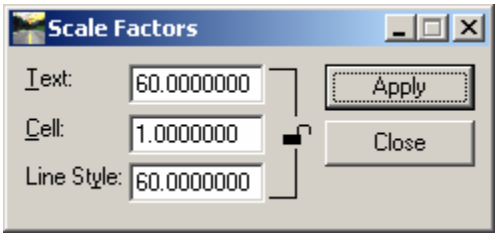


Figure 20-8: Scale Factors

Click **Apply** and **Close** the Scale Factors dialog.

Step Five: Create Cross Section

There are a lot of settings predefined for you in the **Create Cross Section** dialog. There are some items that need to be set before displaying them. To the left of the dialog is an explorer tree of settings. We will discuss the bare minimum to cut sections at 50 foot intervals.

✓ ***For more information on this dialog refer to InRoads help.***

Part One: General

In the **General** area items have been preset for 50 foot intervals. You could choose to change the **Interval:** to 25 feet here. The only other thing is to select what **Surfaces:** you will want to display.

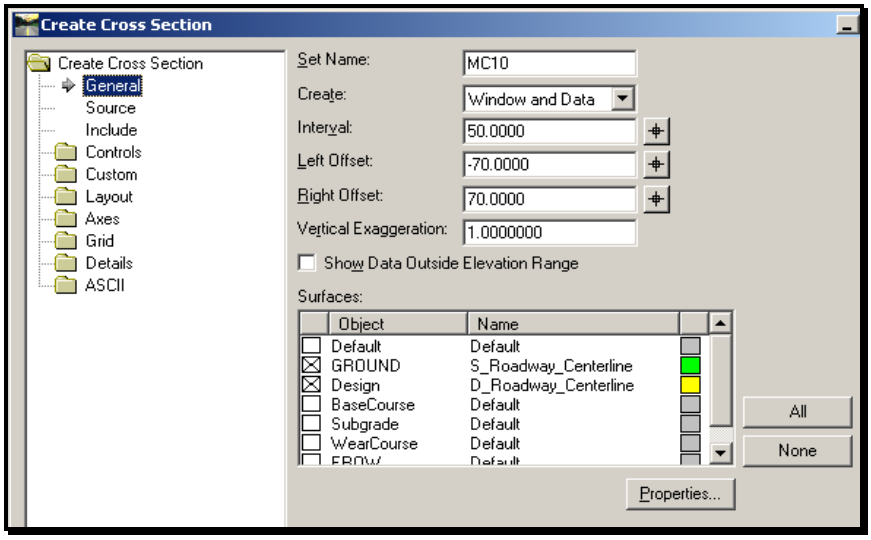


Figure 20-9: Create Cross Section General

The figure above shows that we have **Ground** and **Design** selected for display in sections with an **X** indicating them being selected. If under the **Name** portion the symbology is set to **Default** then you will need to change this by selecting **Properties…** (Figure 20-10).

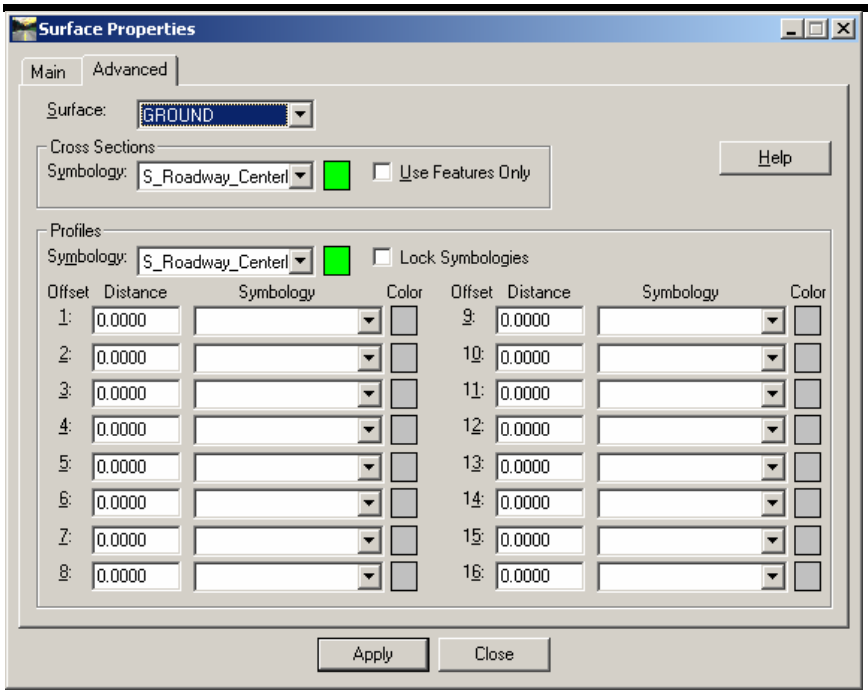


Figure 20-10: Surface Properties

In the **Advanced** tab select the **Ground** surface and set the **Cross Sections** and **Profiles Symbology** to **S_Roadway_Centerline** and click **Apply**. Select your **Design** surface and set the **Cross Sections** and **Profiles Symbology** to **D_Roadway_Centerline** and click **Apply**. **Close** the dialog.

Part Two: Add Existing Right of Way

In order to display the Existing Right of Way in your cross sections, you will have had to create a EROW surface. Include this surface to display it on your cross sections.

✓ ***Refer to page 16-11 for instructions on creating an Existing Right of Way surface.***

Part Three: Source

The Source selection will be set to **Alignment**. By default this field will be populated by the active alignment. If this is not the alignment that sections are to be cut to then use the pull down to select your alignment (Figure 20-11).

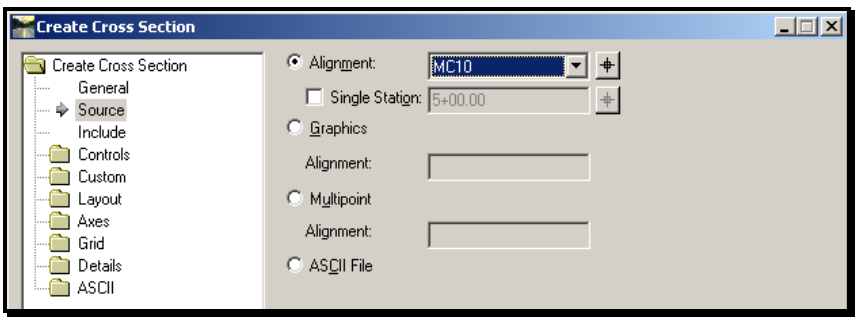


Figure 20-11: Create Cross Section Source

This is the location where you could select **Single Station** to cut a particular section perpendicular to your centerline within a border.

Part Four: Include

In the **Include** section there isn't anything that needs to be at this time. This is where we control how random point features get placed into the cross section drawings.

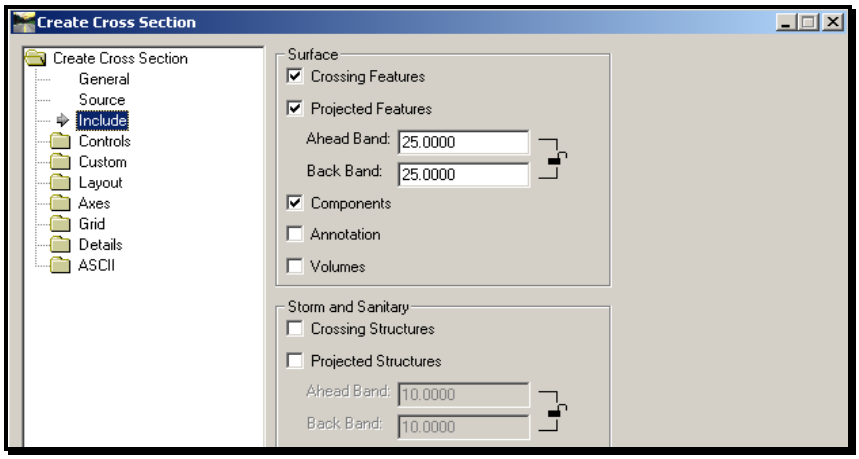


Figure 20-12: Create Cross Section Include

Part Five: Controls - Limits

The controls section by default is setup to cut sections along the whole alignment. In the **Limits** area you could limit the range of sections to display by toggling on **Station** and specifying a start and stop station (Figure 20-13).

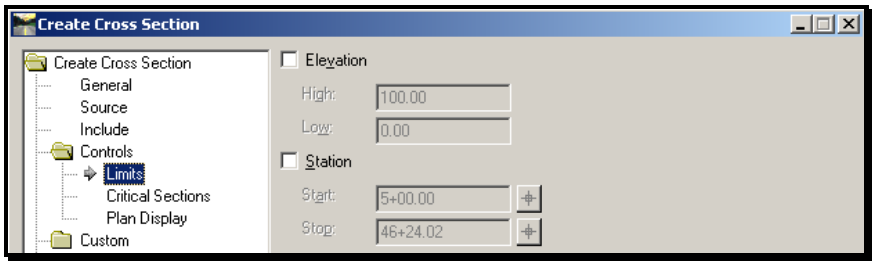


Figure 20-13: Create Cross Section Controls - Limits

Part Six: Controls – Critical Sections

The **Critical Sections** are setup by default to include **Horizontal Event Points** and **Superelevation Event Stations** you could choose to also include other critical sections here (Figure 20-14).

✓ ***For more information on this dialog refer to InRoads help.***

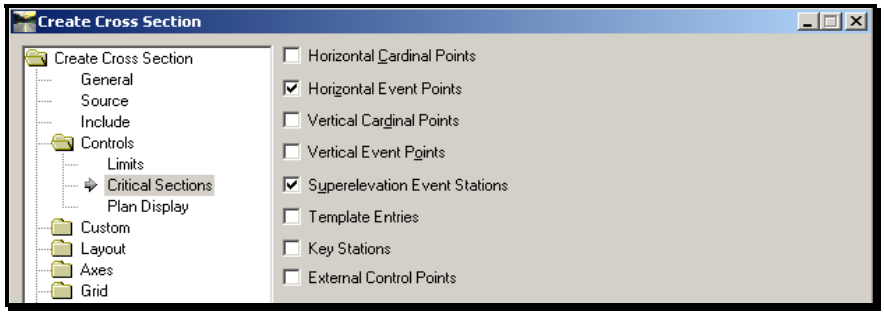


Figure 20-14: Create Cross Section Controls - Critical Sections

Part Seven: Controls – Plan Display

The **Plan Display** section has been predefined to place the cross section drawings at a z elevation of zero. The **Symbology** portion could be toggled on to see the relationship of each section relative to the plan layout (Figure 20-15).

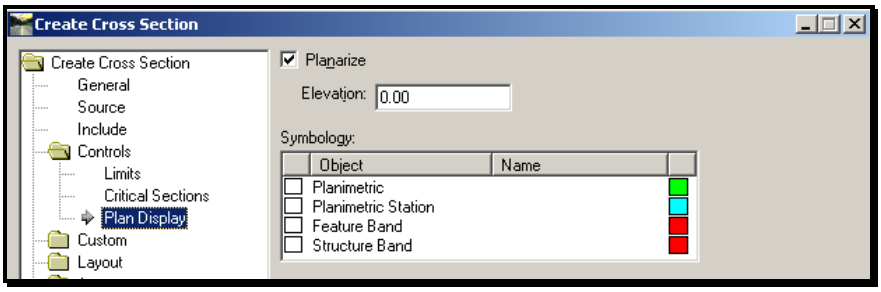


Figure 20-15: Create Cross Section Controls - Plan Display

- The rest of the folders in the explorer tree have been predefined and there will be no need for the general user to have to make changes. Further in this document there will be a setup procedure of the Custom folder for cross section displays.

Step Six: Click Apply

Click **Apply** and you will prompted to **Identify Location**. Send a left mouse button (data click) anywhere in the view window of MicroStation.

Step Seven: Clean Up (hold)

All cell placements left of centerline will need to be mirrored to represent proper offset placement within the cross sections. You will wait to do this after you have annotated the existing features in the next step.

CROSS SECTION ANNOTATION

CROSS SECTION ANNOTATION

Step One: Existing Annotation

✓ ***Refer to the Global Scale Factor in the overview to ensure correct annotation scale.***

Select **Evaluation>Cross Section>Annotate Cross Section…** from the *InRoads Main Menu*.

Select the **Preferences** button and load the **EXISTING** preference by double clicking it or highlighting it and selecting **Load** (Figure 20-16).

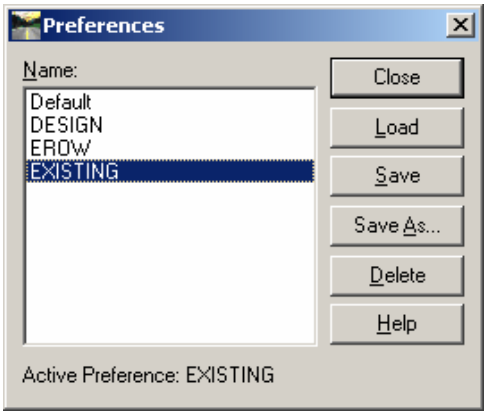


Figure 20-16: Preferences - Annotate Cross Section

Close the dialog.

Set the filter lock to **CROSS SECTION ANNOTATION** (Figure 20-17).

Figure 20-17: Filter Lock Cross Sections

Part One: General

If there are multiple sets of cross sections in the file then verify what **Cross Section Set:** that is intended to be annotated by using the pull down or selecting the cross section set graphically with the target selector (Figure 20-18).

Select your **Ground** surface with an **X**.

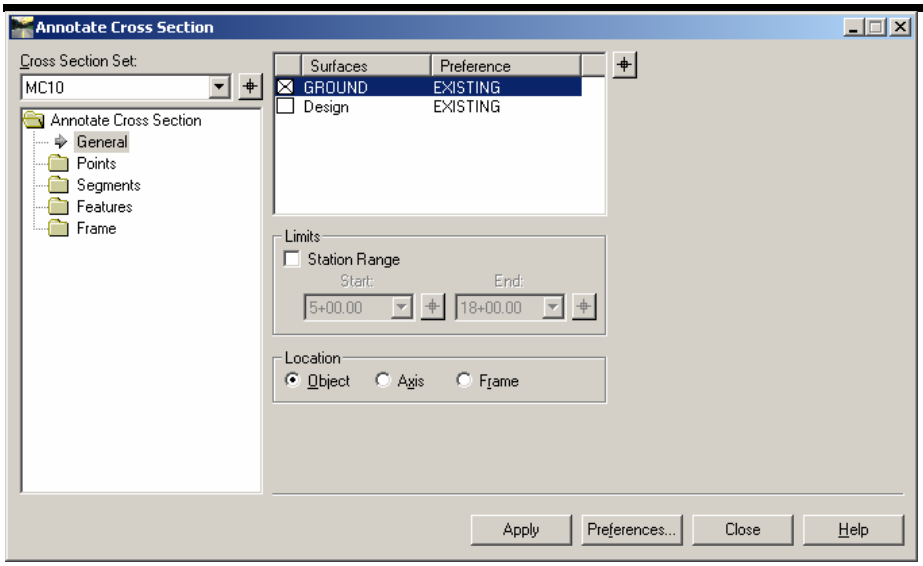


Figure 20-18: Annotate Cross Section - General

Part Two: Features

Select the **Features** folder in the explorer tree and highlight **Annotate** (Figure 20-19). Right click on any Feature in the **Feature:** list area and pick **Select All**.

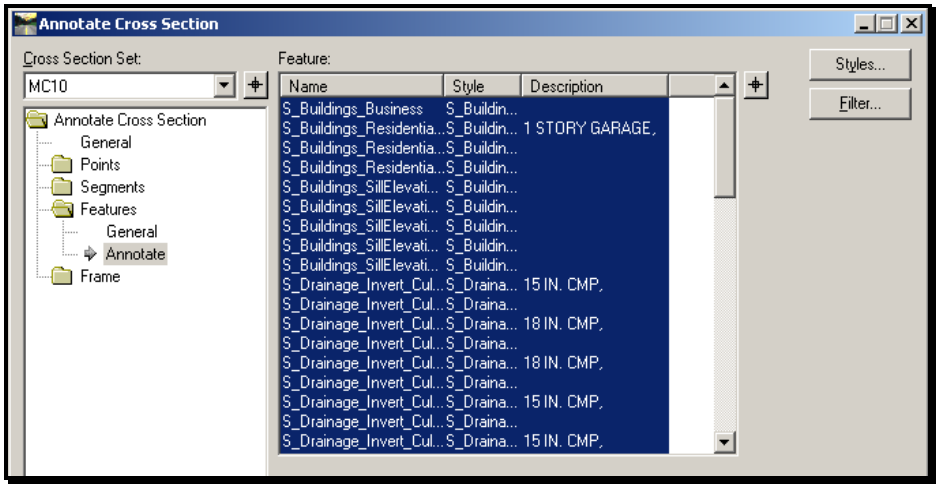


Figure 20-19: Annotate Cross Section – Features

Click **Apply**.

- There will be a need to do some clean up of the annotation, removal of commas, changing all the Rt. to Lt. on the left side of the cross section set and any other incidental cleanup for plan presentation.

Step Two: Proposed Annotation

Select the **Preferences** button and load the **DESIGN** preference by double clicking it or highlighting it and selecting **Load** (Figure 20-20).

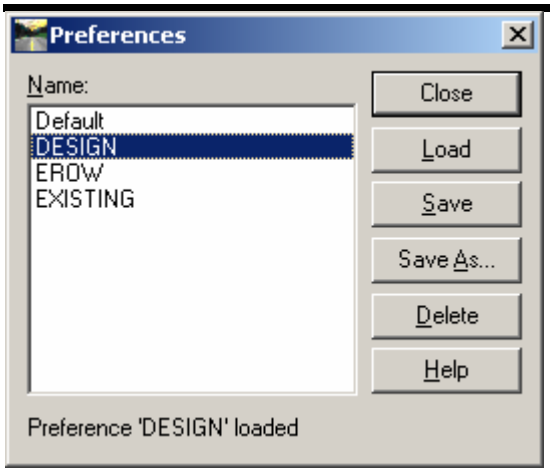


Figure 20-20: Preferences – Design

Part One: General

Select your **Design** surface with an **X**.

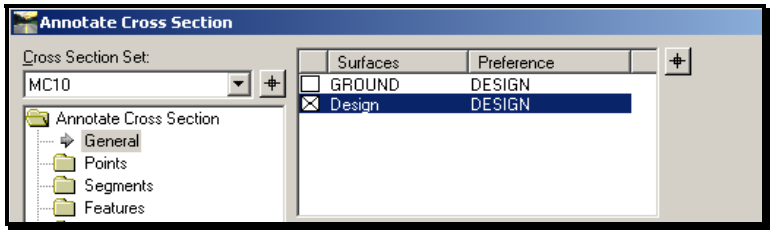


Figure 20-21: Annotate Cross Section - General Design

Part Two: Points

The Points folder has been turned on for the design preference. This folder establishes standards for labeling the centerline station elevation. The general user does not need to change things here.

Part Three: Segments

The Segments folder has been turned on with the design preference. This folder establishes standards for labeling cross slope percents and side slope ratios. The general user does not need to change things here.

Part Four: Features

Select the **Features** folder in the explorer tree and highlight **Annotate**. Right click in the **Feature:** area and **Select All**.

Click **Apply**.

- There will be a need to do some clean up of the design annotation for plan presentation.

Step Three: Existing ROW Annotation

Select the **Preferences** button and load the **EROW** preference by double clicking it or highlighting it and selecting **Load** (Figure 20-22).

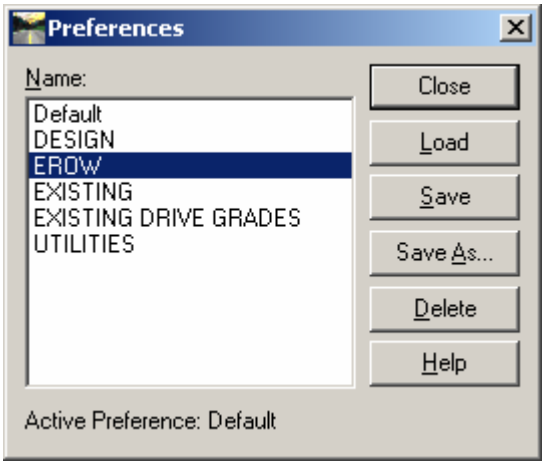
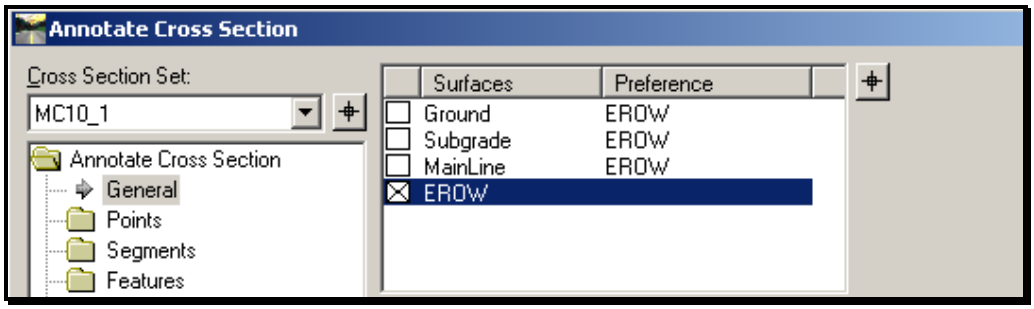


Figure 20-22: Preferences - EROW

Part One: General

Select the **EROW** surface with an X.



Part Two: Features

Expand the **Features** folder and select **Annotate.** Right click on the features in the *Feature* portion of the dialog and **Select All** (Figure 20-23).

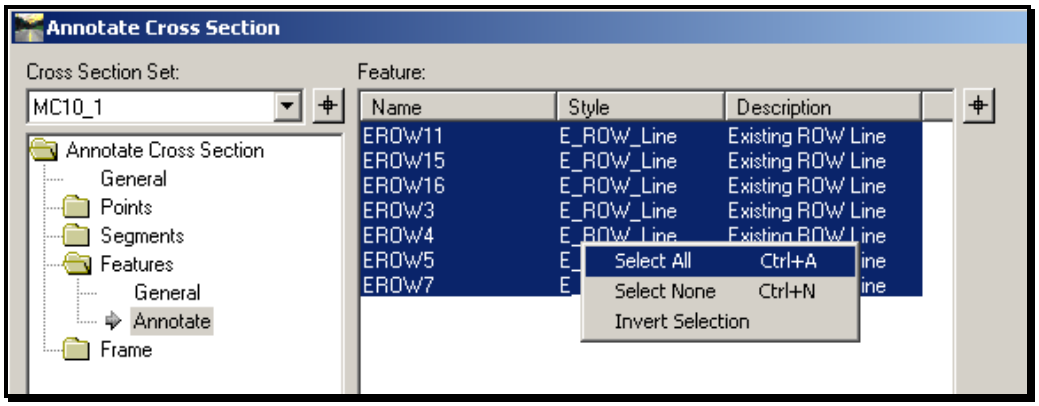


Figure 20-23: Select all of the Features for EROW.

Click **Apply.**

Step Four: Edit Left Side of Cross Sections

All cell placements left of centerline will need to be mirrored to represent proper offset placement within the cross sections and all annotation for existing features will need to be cleaned up to remove the negative value and change the RT. to LT.

Select **InRoads>Edit Left Side Cross Sections** from the *MicroStation Main Menu*. This will launch a **VBA** that will mirror all existing cells placed on the left side of each cross section sheet and will fix the annotation for the left side as well.

- If you have run this program before annotating you will have to run it again to fix the text and one more time to readjust the cells.

CREATING YOUR FINAL CROSS SECTION DRAWINGS

OVERVIEW

Custom sections will probably be the way a designer will want to manage the cross section set of drawings. This method allows for multiple ways of controlling what sections are necessary for display throughout the project. **Custom Sections** does look at **Controls>Critical Sections…** in development of the cross section drawings but does not look at the **General** information for standard intervals and offsets but does look at what **Surfaces:** are to be displayed.

- ✓ ***Refer to Step Five: Part One for General settings.***
  - If you already saved Custom Cross Sections while designing your driveways, select the *Import* button and import your custom sections.

STATION RANGE

Step One: Type

If necessary, re-open the *Create Cross Sections* dialog (**Evaluate>Cross Sections>Create Cross Sections).** There are a few settings that need to be set before clicking the **Add** button. Set the **Type:** to **Station Range**.

Step Two: Details

In the **Details** area of the dialog you can set the **Start** and **Stop Station:** if the project limits are different than the length of alignment developed.

The **Interval:** area will need to be set to desired section cuts (Figure 20-24). In this example we will set it to 50 foot intervals.

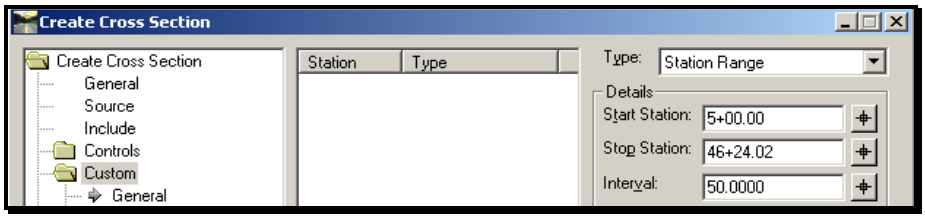


Figure 20-24: Create Cross Section - Custom – General

Depending on what preference was selected will determine the **Left** and **Right Offset:** (Figure 20-25). Refer to **Create Cross Section>General** leaf of this dialog to see what the offsets are and use those values here. Remember to use a negative value for the **Left Offset**.

The **Skew Angle:** will be set at **0 degrees** to maintain perpendicular section cuts along the alignment.

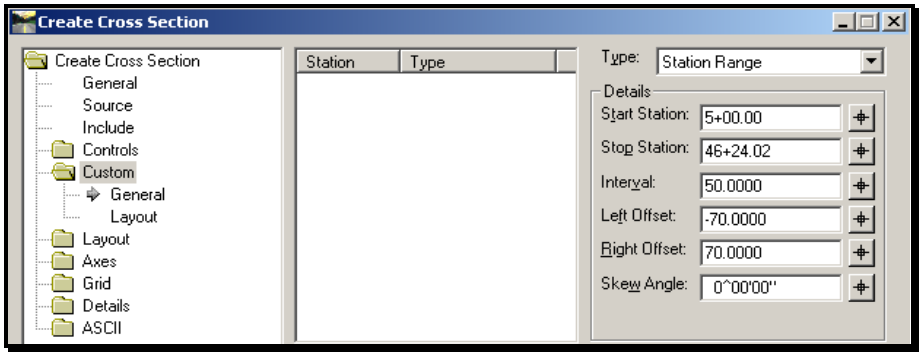


Figure 20-25: Create Cross Section - Custom – Station Range

Step Three: Features

In the **Features** area toggle on both **Crossing** and **Projected** and set the **Ahead Band** and **Back Band** to half the value of the **Interval:** value used. In this case we used 50 foot intervals so we will set these values to **25** (Figure 20-26).

Click the **Add** button to populate the **Station/Type** area.

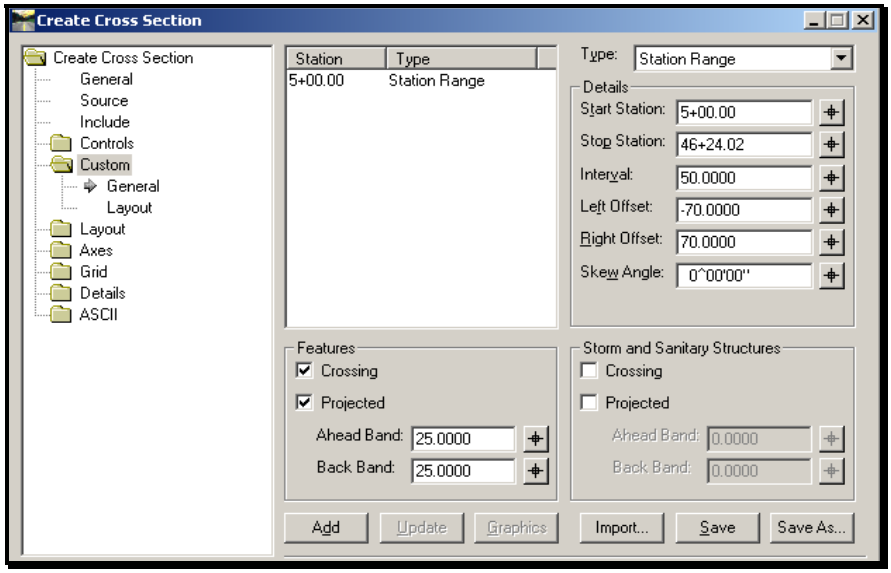


Figure 20-26: Create Cross Section - Custom – Features

- At any time adjustments can be made to the preset values by highlighting the entry in the **Station/Type** area, make the necessary changes and clicking the **Update** button.

PERPENDICULAR

Overview

Horizontal Event stations to cut special sections perpendicular to the alignment takes on the general offsets of the Station Range and does not allow management of the left and right offset values. The Perpendicular option in the custom area allows for manipulation of the left and right offsets.

Step One: Type

Set the **Type:** to **Perpendicular**.

Step Two: Details

Part One: Station

In the **Details** area you can type the station you want or use the picker to graphically select the station within the view window.

Part Two: Left and Right Offset

Depending on what preference was selected will determine the **Left** and **Right Offset:** (Figure 20-27). Refer to **Create Cross Section>General** leaf of this dialog to see what the offsets are and use those values here. Remember to use a negative value for the **Left Offset**.

Part Three: Add

Click the **Add** button to populate the **Station/Type** area.

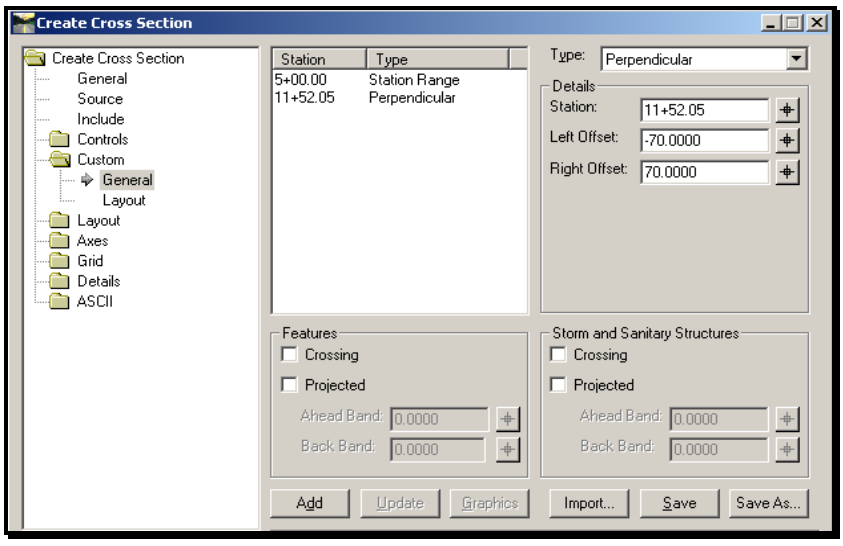


Figure 20-27: Create Cross Section - Custom - Perpendicular

- The offsets shown in Figure 20-27 are for a full section matching the standard left and right offsets of the Station Range. If there is a need to have more of a section to the right of centerline the values could be adjusted to reflect the need. For

example if the **Right Offset:** needed to be 100 feet then the **Left Offset:** would need to be set to -40 feet giving a total distance of 140 feet.

SKEWED STATIONS

ⓘ ***If you are running InRoads Suite Version 8.8 you will have issues annotating Skewed sections over 60 degrees with design components and will be kicked out of the Bentley package.***

Step One: Type

Set the **Type:** to **Skewed**.

Step Two: Details

Part One: Station

In the **Details** area you can type the station you want or use the picker to graphically select the station within the view window. If there is a feature crossing the alignment then use the *MicroStation* intersect snap to get the exact station.

Part Two: Left and Right Offset

Depending on what preference was selected will determine the **Left** and **Right Offset:**. Refer to **Create Cross Section>General** leaf of this dialog to see what the offsets are and use those values here. Remember to use a negative value for the **Left Offset**.

Part Three: Skew Angle

- All skewed stations by default will be skewed back right. If you want a skewed back left section you must place a negative sign in front of the angle measured and InRoads will translate the appropriate angle.

From the *MicroStation Main Menu* load the plan sheet settings manager. Select **Symbols & Linestyles>Junk Lines**.

Place a line along the crossing feature (Figure 20-28) you would want sectioned at a skew (i.e. crossing pipe).

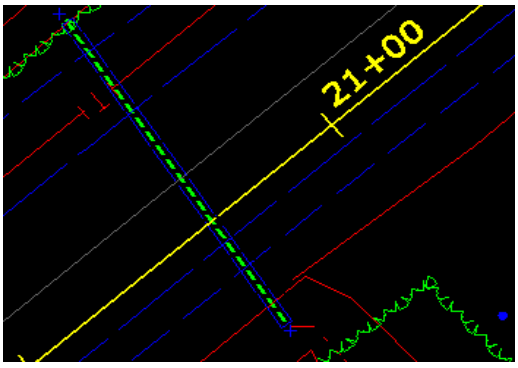


Figure 20-28: Junk Line along Crossing Feature

On Alignment Tangent (Option 1)

Using the SmartLine tool in conjunction with the perpendicular snap place a perpendicular line (Figure 20-29) near the other junk line placed earlier for the crossing feature.

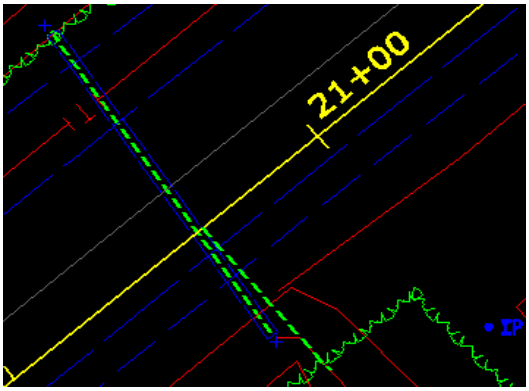


Figure 20-29: Perpendicular Junk Line

From the *MicroStation Main menu* select **Measure>Angle** and follow the prompts in the lower left to measure the angle.

On Alignment Tangent (Option 2):

Using the *MicroStation* SmartLine tool place a perpendicular line starting from the intersection of the structure and centerline out to a random point.

- Hint: with AccuDraw having focus use the "**I**" for intersection, "**O**" to set AccuDraws origin, "**RQ**" to rotate AccuDraws compass, "**N**" for a nearest point on alignment and "**Enter**" to lock the compass. Place the line.

✓ ***For more on using AccuDraw refer to page 2-42.***

Highlight the resulting angle (Figure 20-30) to **Copy** and **Paste** it into the **Skew Angle:** area of the **Create Cross Section** dialog.

Figure 20-30: Measure Angle between Lines

On a Radius:

Using the **Junk Line** option from the settings manager place a line from the intersection of the alignment and crossing feature to the center of the arc.

- Hint: with AccuDraw having focus use the "**I**" for intersection and the "**C**" for center and tentative snap to the arc and accept.

Highlight the resulting angle (Figure 20-30) to **Copy** and **Paste** it into the **Skew Angle:** area of the **Create Cross Section** dialog.

Click the **Add** button to populate the **Station/Type** area.

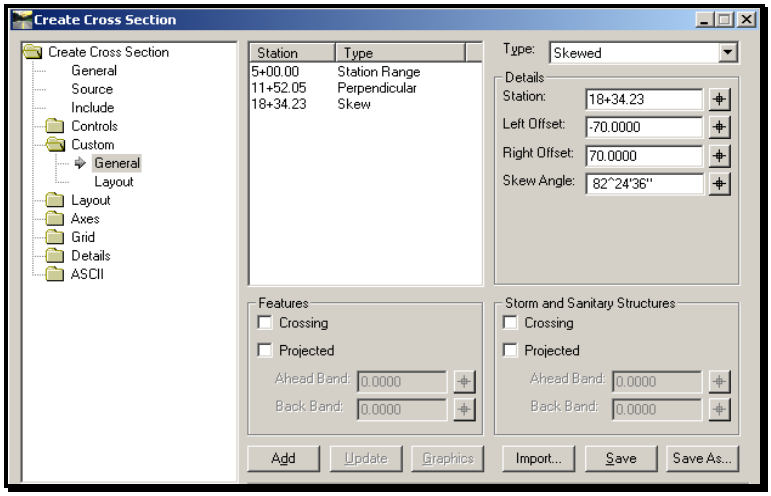


Figure 20-31: Create Cross Section – Custom – Skewed

LINE STRING STATIONS

ⓘ ***If you are running InRoads Suite Version 8.8 you will have issues annotating Line string sections with design components that have a relative skew to the alignment of more than 60 degrees, you will be kicked out of the Bentley package.***

Overview:

A line string is an element that has a start and end point and also has one or more vertices within it. You could use a straight line with this option and InRoads will consider it a skewed section and place it in the dialog as this. One use for Line string sections would be for the centerline driveway alignments.

Step One: Type

Set the **Type:** to **Linestring**.

Step Two: Station/Type

Using the PowerSelector pick the line strings (Figure 20-32) drawn perpendicular from centerline out to the apron and through the driveway.

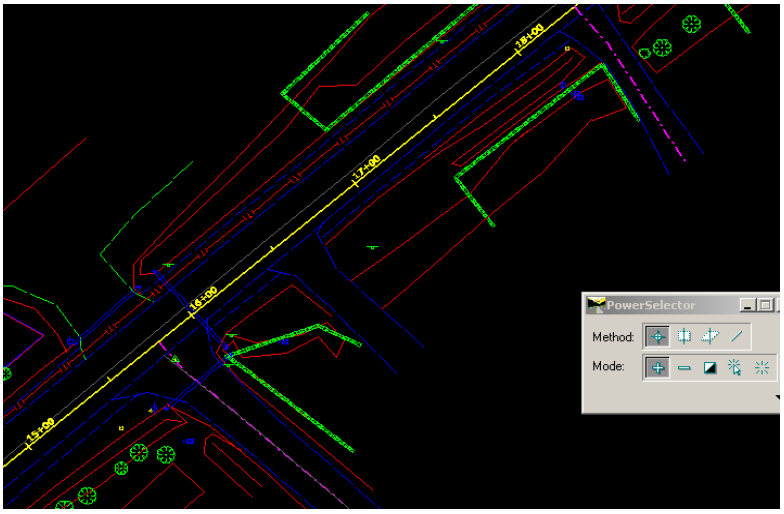


Figure 20-32: Driveway Centerline Line Strings

Having a selection set picked within MicroStation will activate the **Graphics** button in the **Custom** folder of the **Create Cross Section** dialog box. Select the **Graphics** button (Figure 20-33) to populate the **Station/Type** area of the dialog.

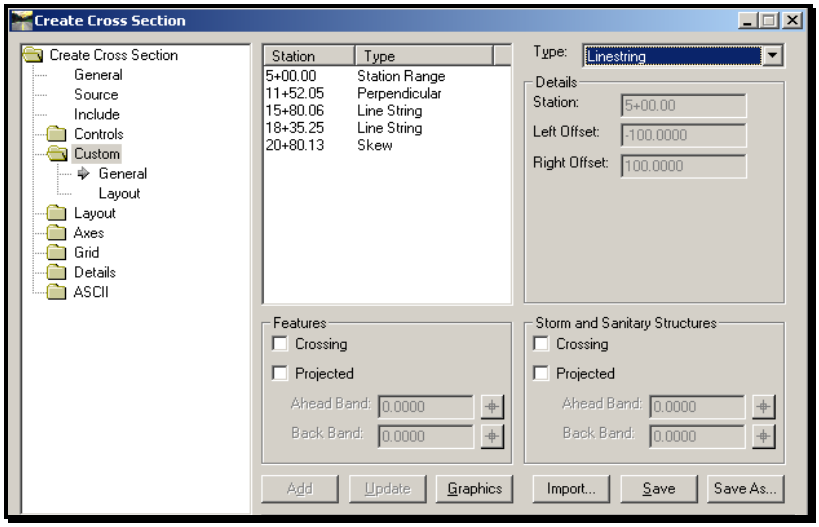


Figure 20-33: Create Cross Section – Custom – Line String

If you highlight one of the line strings within the **Station/Type** area of the dialog (Figure 20-34) you will be able to see the details relative to centerline to the right.

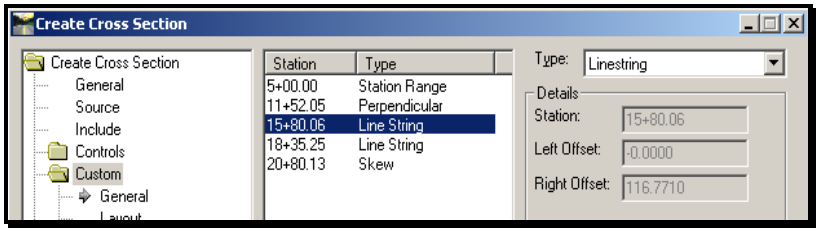


Figure 20-34: Line String Details

If the overall measurement of the **Left** and **Right Offset** values exceed that of the **Station Range** offset value total then you should shorten the overall length of the line string (i.e. 140 foot maximum length for 5 foot horizontal sheets).

- If you need to remove a station in the list simply highlight the station and press the **Delete** key on your keyboard.

When done setting up your Custom Sections click on the **Save** button and name the *.xsc for future retrieval.

Step Three: Annotation

- Refer back to Annotation portion of this chapter to apply annotation and running the **VBA** application to fix the left sides of your cross section set.

CREATING SINGLE CROSS SECTION FILES

Overview:

By default InRoads places all cross sections within the same file. For efficiency purposes to utilize resources within your team we have created a method to build individual files of each cross section drawing page. These are a copy of the originals and are not linked to the master file.

Creating Single Cross Section Files

Select **InRoads>Create Single Sheet Cross Sections** from the *MicroStation Main Menu*. This will launch a **VBA** that will prompt you for a Starting Page Number (Figure 20-35).

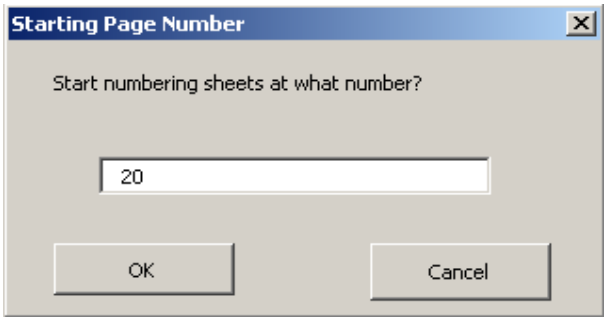


Figure 20-35: Starting Page Number

Determine what number you would like to start with and press **OK**.

The program will loop through all sections placed in the master file based on the priority they were placed in the file and create fence file drawings with a prefix number, a root name of **XSECT**, the first identifiable section on each sheet and an incremental suffix for total number of cross section sheets. For example the file name would look like this: **020_XSECT_5+00_001.dgn**.

You can now process the border information onto each of the drawings through our normal process once these drawings are created. This will turn off the appropriate levels based on what workgroup you belong to, it will fit the view and a Save Settings will be done as it loops through the files.

✓ ***For more on Border Information please refer to page 1-27.***

END AREA VOLUMES

DISPLAY VOLUMES ON SECTIONS

Overview

The *End Area Volumes* are based on the closed components of the *Templates*. If these *Components* are manipulated in the Cross Sections, their end area volume will adjust accordingly. The *Components* have been named appropriately so that like items will be quantified together and eventually quantified with the InRoads *Quantity Manager*.

Some volumes may need manual adjustments to better represent the item estimated. For example, pavement or base pavement layers may consist of multiple items that need to be broken out separately.

For more accurate volumes, it may be necessary to add additional cross sections at certain stations in order to capture the best representation of the surface and sub-surface conditions (i.e. Guardrail widening areas).

Step One: Basic End Area Volumes

Select **Evaluation>Volumes>End-Area Volume…** from the InRoads main menu (Figure 20-36).

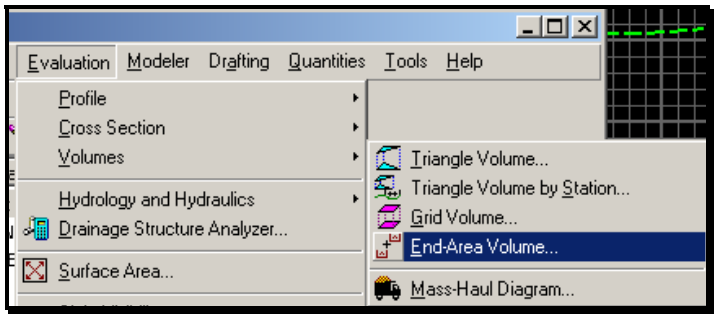


Figure 20-36: End Area Volume menu.

Step Two: Setup the Dialog's General Tab

Verify that the active *Cross Section Set* is set to your Cross Sections your want to create volumes from and your **Ground** and **Design** surfaces are selected. Place a check mark in the *Create XML Report* check box. If the project has a lot of curves in it, place a dot in the *Correct for Curvature* radio button (Figure 20-37).

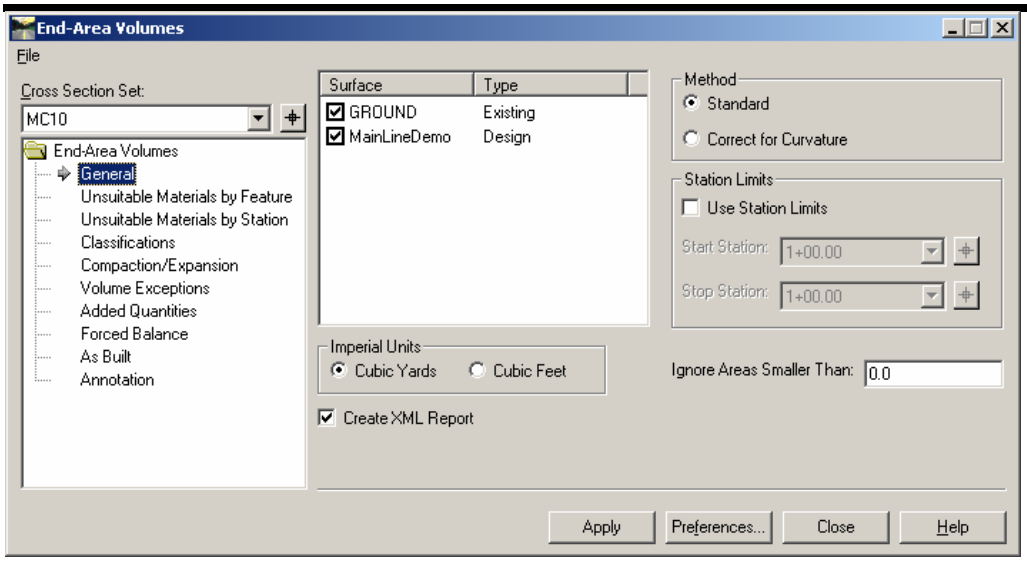


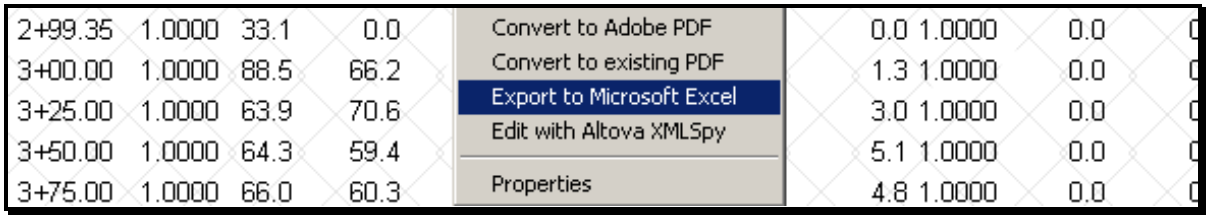
Figure 20-37: End-Area Volumes General tab dialog.

Step Three: Click Apply

Verify that the *Global Scale Factors* are set correctly for Cross Section display (**Tools>Global Scale Factors = 60, 1 and 60).** The remainder of the settings have been set for you. This is assuming that you want text placed on cross sections of Cut and Fill Quantities. Click **Apply** and then **Close.**

View End Area Volume Report

Select which *End Area Volume* style sheet you would like to use (i.e. EndAreaVolumePageTotals.xsl). An option would be to right click on the report and select **Export to Microsoft Excel** and include only the columns you want to display for your estimate.



Other Volumes

Switch the *Style Sheet* to **Volumes.xsl** to view the volumes of all the other closed components. They are listed by their *Styles.* If areas are required for the item you want to estimate, export the report to Excel and manipulate the report in the spreadsheet to the desired output.

Other Adjustments

There are many other adjustments that can be made and quantities calculated. Please refer to InRoads **Help** for a dialog that you want help with.

- **Unsuitable Materials (by Feature or Station)** – This could be used to determine Muck Excavation, Loam Salvage, Pavement Salvage and Waste Storage Areas.
- **Classifications** – This can be used to identify other surfaces such as Rock or Structural Rock Excavation.
- **Compaction/Expansion** – This can be used to add the factors for Cut (1.15) and Fill (0.85) but normally this is calculated within the *Summary of Excavation and Borrow.*
- **Volume Exceptions** – Allows you to deduct a station range from the *End Area Volumes* to be calculated manually.
- **Added Quantities** – Allows you to add additional cut or fill using a station range.
- **Forced Balance** – Allows you to reset the cut or fill values to zero at a specific station.
- **As Built** – Requires that you have an As Built surface to include.
- **Annotation –** This is where you set up what you want annotated as well as add color to the cut and fill shapes.

Volumes for Driveways

In order to get better volumes for driveways, consider creating a cross section set that has a section at the start and stop for every drive. This way the averaging may give more accurate results.